

REMARKS

Claims 1-4 and 6-12 are in this application. Claim 5 has been cancelled. Support for the amendments to claim 1 is found *inter alia* on page 1; page 4, lines 25-27; and page 5, lines 1-14 of the specification. Support for new claim 12 is found on page 5, lines 15-17. Support for the amendment to claim 3 is found on page 5, line 13.

Claim 1 has been amended to replace the word glycerine with glycerol and claim 3 has been amended to delete the word distillation. Therefore, the objection to claim 1 and the rejection of claim 3 as being indefinite are moot. It is respectfully requested that this objection and rejection be withdrawn.

Claims 1-4 and 6-11 are rejected under 35 USC 103(a) as being unpatentable over Yoo, (US 2005/0080280 corresponds to WO 03/066567) in view of Yean et al. (Applied Organometallic Chemistry, 2000, vol. 14) Ciaudelli (US 4,567,037) and Ma et al. (Bioresources Technology, Vol. 70 pp 1).

Claims 1-4 and 6-10 are rejected under 35 USC 103(a) as being unpatentable over Yoo, (UD 2005/0080280 corresponds to WO03/066567) in view of Yean et al. (Applied Organometallic Chemistry, 2000, vol. 14) Ciaudell (U.S. 4,567,037), Ma et al. (Bioresources Technology, Vol. 70 pp 1) and Phelps et al. (U.S. 6,962,968).

These rejections are respectfully traversed.

The invention claimed in the present patent application is quite different than that disclosed by Yoo. et. al (WO 03/066567 A). Some of the differences are:

- (1) The fatty acids used for transesterification are in the form of glycerides.
- (2) In the process of present invention the fatty acids can be in the form of glycerides or free fatty acids or combinations thereof. The present invention relates to a process wherein esterification of free fatty acids and transesterification of glycerides occur simultaneously in one step wherein Yoo's patent is applicable for transesterification of fatty acid triglycerides only.
- (3) The process claimed in the present application is also applicable to esterification of pure fatty acid as indicated in the example of 7 wherein pure oleic acid was used for esterification.
- (4) The present process is carried out under high pressure as indicated in (claim 1) wherein the pressure lies between 1 to 30 bars.
- (5) Yoo has clearly emphasized that the temperature should not exceed beyond 150°C. Whereas in the present invention, the process can be carried out at a temperature above 150°C. In the present process, the temperature of the reaction can exceed 150°C (up to 300°C) without resulting in problems such as carbonization and saponification.
- (6) The molar ratio of triglycerides to alcohol reported by Yoo, et al. is 4.5 to 7.5. In the claimed invention the ratio of the oil to alcohol is up to 1:30.

Ma is a review article describing the base catalysed transesterification of vegetable oil. The process described in Ma can not tolerate the presence of free fatty acids and moisture which differs from the claimed invention.

It is noted that the Examiner cited this reference for the description of triglycerides.

The present invention uses a non-alkaline catalyst instead of KOH under quite different operating conditions.

Yean describes a study on the kinetics of transesterification of tripalmitin carried out using tin compounds as catalyst. One of the catalysts used is dioctyl tin oxide.

However, the main differences between Yean's disclosure and the claimed invention are:

(1) Yean has been carried out with only pure tripalmitin (95%) as feedstock. In the claimed invention natural vegetable oil which contains various impurities like free fatty acids, phospholipids, sterols, water, odorants and other impurities, which effect the transesterification reaction can be used. Yean does not include the esterification of the fatty acids either individually or in combination with glycerides of fatty acids.

Further esterification of fatty acids with or without the presence of glycerides and other impurities is not obvious in view of Yean.

(2) In the present invention, esterification and transesterification is carried out simultaneously. In all the examples cited the free acid content varied from 8% to 100%. This differs from the disclosure of Yean.

(3) In Yean, the reaction was carried out in the presence of tetrahydrofuran as solvent to make the system homogeneous. The process of present invention does not use tetrahydrofuran as a solvent.

(4) In the Experimental section of Yean the transesterification studies were carried out using extremely large concentration of alcohol and solvent (THF) e.g. (≈ 3750 times and ≈ 1000 times respectively w.r.t. Tri-palmitate on molar basis as to make the system homogeneous. In the present invention the reaction was conducted at a concentration of alcohol (1:3- 1:30) on mole basis which is a significantly lower concentration than Yean, and without the use of additional solvent. This makes the system heterogeneous having three phases.

The reaction occurring in a heterogeneous system without solvent is not obvious.

(5) In the above paper the reaction was carried at 70°C and atmospheric pressure whereas the process of present invention study is conducted at $70^{\circ} - 300^{\circ}\text{C}$ and under moderate pressure (1- 30 bars). Yean has carried out the reactions at maximum temperature of 70°C at atmospheric pressure while in the present invention a preferred temperature range is $150-200^{\circ}\text{C}$ as mentioned above. Even the autogenous pressure generated with methanol at $150-200^{\circ}\text{C}$ lies in the range of 10-25 /bar, which is much above the pressure range disclosed in Yean and there is no overlapping of the pressure range. Hence the reaction conditions are entirely different and there is no over lapping of any reaction parameter in the Yean's condition and the conditions claimed in the present patent application.

Phelps discloses the use of alumina type of adsorbents to remove impurity from oligomers. This is quite different than removing impurities from fatty acid esters as claimed in the present application. The raw materials used in the claimed invention may contain phospholipids, tocopherol, dissolved catalyst and other impurities. The use of alumina type of adsorbents for removal of impurities from fatty acid methyl esters is not obvious in view of Phelps. The present invention teaches a new application of the principle of adsorption and use of adsorbent viz. to purify fatty esters.

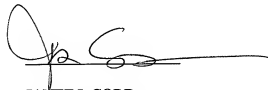
Although Ciaudelli discloses the use of dibutyl tin oxide, Ciaudelli in combination with the cited references does not make the claimed invention obvious.

In view of the above explanation the present invention is new and not obvious.

Therefore, as none of the claims are obvious, it is respectfully requested that the rejection be withdrawn.

It is submitted that the application is in condition for allowance and favorable consideration is respectfully requested.

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'Janet I. Cord', with a long horizontal line extending to the right.

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